Diabetic Retinopathy Detection Using Deep Learning

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Abstract: The eye is a vital organ in human anatomy, uniquely allowing non-invasive examination of its interior, including vascular and brain tissues, from the outside. While retinal fundus images are traditionally used to diagnose ophthalmic conditions, they also provide critical information about systemic health. Diabetic Retinopathy (DR), a severe complication of diabetes, can cause irreversible vision loss if not detected and treated promptly. Manual examination of retinal fundus images for DR detection is time-consuming, subjective, and limited by the availability of expert clinicians. In contrast, automatic DR detection methods offer greater efficiency, cost-effectiveness, and speed. Recent advancements in deep learning (DL), particularly convolutional neural networks (CNNs), have shown promising results in automating DR detection from retinal fundus photographs. In this study, we present a custom MobileNetV2 architecture modified for DR detection using fundus images from Sri Lankan patients, aiming to improve the accuracy, efficiency, and accessibility of early detection. The dataset used for model training comprises 255 DR and 17 normal fundus images collected from General Hospital Kandy in Sri Lanka. These images were meticulously annotated to ensure a comprehensive database for analysis. The pre-processing steps included resizing, normalization, and augmentation to enhance training. Unlike common practices that crop images, this study applied text removal techniques to preserve the entire retinal area, ensuring that critical diagnostic features remain intact. After conducting extensive experimentation and employing various fine-tuning techniques, the results demonstrate a 96.08% accuracy, with high precision (98%), recall (94%), and F1-score (96%) for the DR class. This model's ability to detect DR early can significantly impact patient outcomes by facilitating timely intervention. This study provides a comprehensive analysis of DL methodologies and their potential to revolutionize ophthalmology and diabetic retinopathy management in Sri Lanka.

Keywords:Convolutional Neural Network, Diabetic Retinopathy, MobileNetV2, Ophthalmology, Retinal Fundus Images

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